

LEARN Internet

**A (modified) Proposal to Introduce Internet Services to the Academic and
Research Community in Sri Lanka**

Submitted to the UGC/SLIUC

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1.0 Introduction

Campus-wide networking has become an essential part of providing computing services to the users. Recognising this many countries in the developed world were quick to set up Local Area Networks (LANs) connecting the resources which are physically distributed. Wide Area Networks (WANs) spanning the globe, connect these LANs together to make one homogeneous network comprising of heterogeneous computing elements.

The National University of Singapore Campus-Wide Network (NUSNET) is claimed to be the most modern, largest, and the fastest campus network in the Asia Pacific Region.

NUSNET links up 93 departments of study in 90 buildings over a 150 hectare campus. The network is based on state-of-the-art optical fibre networking technologies providing high speed and bandwidth. It provides 3000 network nodes allowing at least one network outlet in every room. The total fibre length is 200 km and the total cable length is 185 km.

NUSNET is a multi protocol network. Currently it supports many popular protocols including FDDI, TCP/IP, Ethernet and Appletalk.

2.0 What is NUSNET ?

NUSNET is a major communication infrastructure which enables the academic community of the National University of Singapore to access all the local computing resources in the University premises as well as have access to the international computer networks linking academic and research institutions world wide using Internet or BITNET (see figure 1). It provides the following network services to the 1600 academic and research staff, 400 administrative staff and 16000 students.

* **Electronic Mail**

* **Application Software Library**

- easy access to a diverse range of software for applications including word-processing, spreadsheets, databases, graphics, programming languages utilities, etc.

* **Host Access**

- to various computers including IBM Mainframe, UNIX hosts and the supercomputer.

- * **LINC Access**
 - NUS Library Integrated Catalogue (LINC)
- * **File Services and Print Services**
- * **Fax Transmission**
- * **International Access**
 - through Internet and Bitnet

2.1 What is Internet ?

Internet is a very large internetwork of many R & D networks spanning the globe. Tens of thousands of Academic Institutions and Research Centres in the world are connected together on the **Internet** to facilitate online sharing of resources and collaboration among researches. It is estimated that more than 10,000 computer networks with about 200,000 host computers connected to them are currently on the **Internet**. Through the News Bulletin Board services available on the **Internet**, it is easily possible to reach about 2 million computer users around the world typically in a matter of seconds.

2.2 Resources available via Internet

Out of the vast array of resources accessible via Internet, the following are worth mentioning.

Library Catalogues : A large number of libraries allow access to their library catalogues via the Internet. Some examples are the Research Libraries Information Network (RLIN) and the Harvard Online Library Information Systems (HOLLIS).

Data Archives : There are a wide variety of data archives, data bases and software distributions ; for example Listing of Molecular Biology Databases (LiMB).

Mail Gateway : Transfer of electronic mail to various networks such as Bitnet, SPAN (Space Physics Analysis Network), HEPNet (High Energy Physics Network), EARN (European Academic & Research Network), JANET (Joint Academic Network of UK), JUNET (Japan Unix Network).

2.3 Internet Network Services

Any user on the **Internet** is provided with the following services as minimum.

Remote Login : Used to access a remote computer anywhere on the **Internet**. Once connected and logged in to the remote host, the user can enter data, run programmes or do any other operations, just as if he were logged directly on to that computer through a local terminal.

This facility is typically used to access interactive data bases, library catalogs, computer resources, etc.

File Transfer : Enables a user to transfer files from a remote computer. Typical usage is for accessing the data archives, public domain software, etc.

Electronic Mail : Lets users send messages electronically to one another. One of the most useful and certainly the most used service on the networks.

NEWS : **NEWS** is the largest distributed conferencing (Bulletin Board) service containing thousands of topics on computer architecture, hardware, software, politics, philosophy, science and technology, social issues, leisure, to name a few. Currently there are about 700 news groups operating.

3.0 Objectives of the NUSNET

- ◆ To establish a platform for the present and future computing based environment to support educational and research requirements at NUS.
- ◆ To integrate the diverse computing equipment within NUS thus facilitating resource sharing.
- ◆ To increase productivity by improving access to information and computing facilities, and to speed up the distribution and sharing of information.
- ◆ To provide an integrated computing environment at NUS where any workstation should be able to transparently gain access to any computer resource of the Network and to initiate computer to computer transfer of data.
- ◆ To enhance the quality of scholarly work by increasing opportunities for collaboration between different departments, as well as with organisations outside NUS and Singapore

In addition to the above, work is underway to set up a networking facility called TECHNET, to provide the Internet Services to the industries, other educational institutes and research institutes through the NUS.

4.0 Purpose of Visit

The purpose of my visit to the NUS Networking Centre was twofold.

1. To familiarise with the networking technologies used in the NUSNET which claims to be the largest and the fastest campus-wide network in the Asia Pacific region.
2. To discuss with the Network Administrator, the details of access to the **Internet** ; the world wide academic and research network which provides online services as described in sections 2.2 and 2.3

The discussion I had with Dr Tommi Chen, Assistant Director (Networking) of the NUS has been extremely rewarding.

During these discussions it was revealed that :

- a. The Government of Singapore has a declared Policy for IT Development with committed funds.
- b. The 64 Kbps international leased line cost from the NUS to the **Internet** node at Princeton University via John von Neumann Supercomputer Centre Network (JVNCnet) is S\$200,000/= per year.
- c. NUS is also paying US\$ 25,000/= to the Princeton University as hosting charges.
- d. Outside users are connected to the **Internet** Gateway at the NUS via local leased lines at 64 Kbps.

It must be noted here that the decision of the NUS to use a more expensive solution of connecting directly to the **Internet** via Princeton is based on their commitment for both Science and Technology development and **IT** development. This makes the NUS to be only one hop away from the **Internet**. If a less expensive solution of connecting to the nearest node was used then NUS has to be many hops away from the **Internet** thereby increasing the vulnerability of the NUS node. This is a clear indication of their dedication to provide the best possible access to the services on the **Internet** with the shortest possible delay and downtime.

4.1 Relevance to Sri Lanka

There is no question of the relevance of providing such networking facilities and services to the scientists and researchers in Sri Lanka if they have no make a meaningful contribution to the national socio economic development through the application of Science and Technology. In this IT has to be treated as a services as well as an industry by itself.

Although a number of proposals were submitted by the Author, the progress in this area has not been substantial. A country wide network to connect up universities and research centres is still non-existent.

One other important point about the NUS effort is the commitment of both the Government of Singapore and the NUS. They have realised that the long term benefits of providing sophisticated networking infrastructure far outweighs the immediate expenditure. The same can be seen from a news item on "Introducing Internet Services in Argentina", which I picked up from the Internet Bulletin Board.

4.2 Outcome of the Visit

I was able to discuss with Network Administrator of the **Internet** Site in Singapore about their hosting Sri Lanka to the **Internet**. If we manage to find funding for the line charges and network terminating equipment, there is a possibility of using the **Internet** Site at the NUS as a backbone site for Sri Lanka. However, since the Internet Site at the NUS is managed as a facility for both the Universities and the industry, it was not clear whether the NUS can host us without a fee.

This I am sure can be negotiated on a government to government basis and if necessary a nominal fee can be made to the NUS at beginning on a trial basis for a period of time.

As a starting point it is possible to arrange with NUS to copy and dispatch a tape (100 MB) every week containing the **Internet NEWS**, if we can bear the cost of tape and courier charges.

Recommendations

1. It is strongly recommended that **Internet** services are made available via LEARN (Figure 2) to the Scientific and Research Community in Sri Lanka.
2. It is recommended that we use the NUS site which is the nearest **Internet** site to Sri Lanka as a backbone site. This will make Sri Lanka only 2 hops away from the **Internet** and because of the dedication of the NUS, an extremely reliable service can be expected.

3. It is recommended that we use X.25 packet switching services to Singapore available through the Network service providers such as Lanka Telenet and Datanet. This is expected to be cheaper than having a leased line to Singapore. However the actual cost will have to be studied in detail before a decision is taken as the cost of X.25 service depends to a large extent on the tariff structure of the service provider.
4. In order to achieve this it is recommended that a government to government request be initiated through the official channels.

Acknowledgments

This visit was made during a one day break journey to Singapore (due to flight connections) on my way to Bali to represent Sri Lanka at the SEARCC Regional Interest Group on Telecommunications (SRIG-TEL). The financial support provided by the UGC is thankfully acknowledged.

I also wish to thank all those who made themselves available for discussions despite their busy schedules and for their kind hospitality.

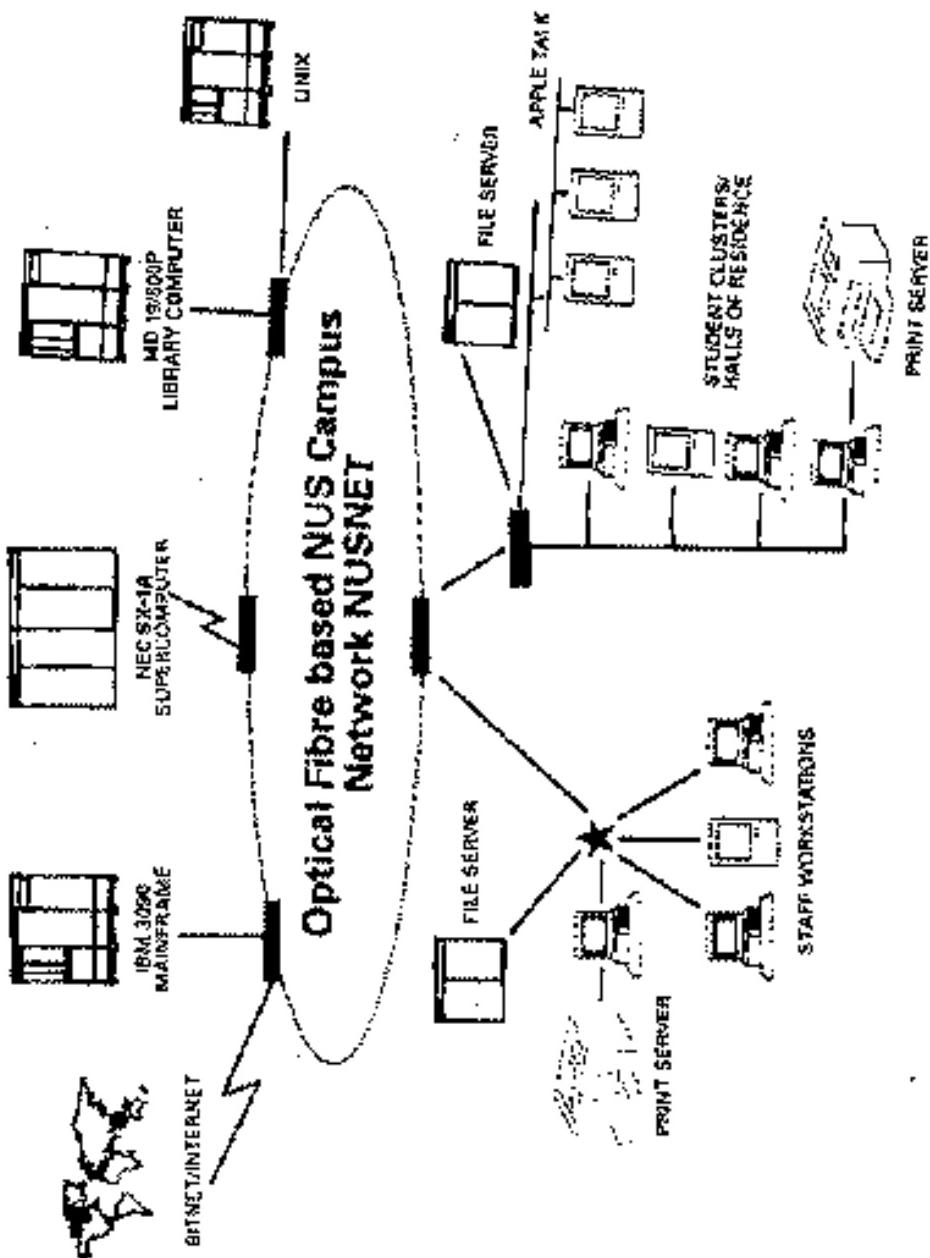


Figure 1. Computing Facilities on the NUSNET
and the International Network Connections

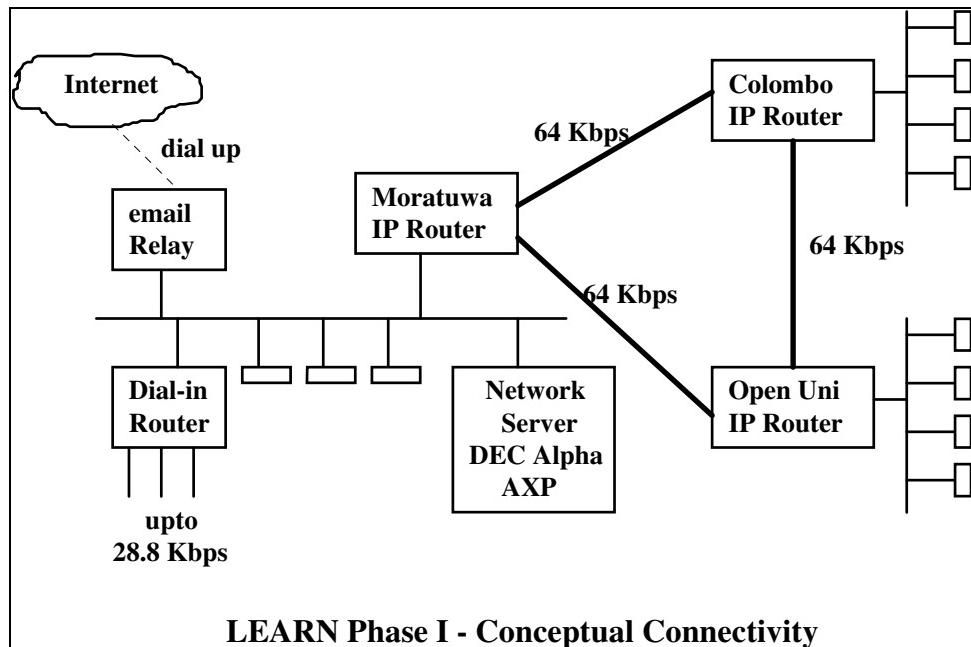
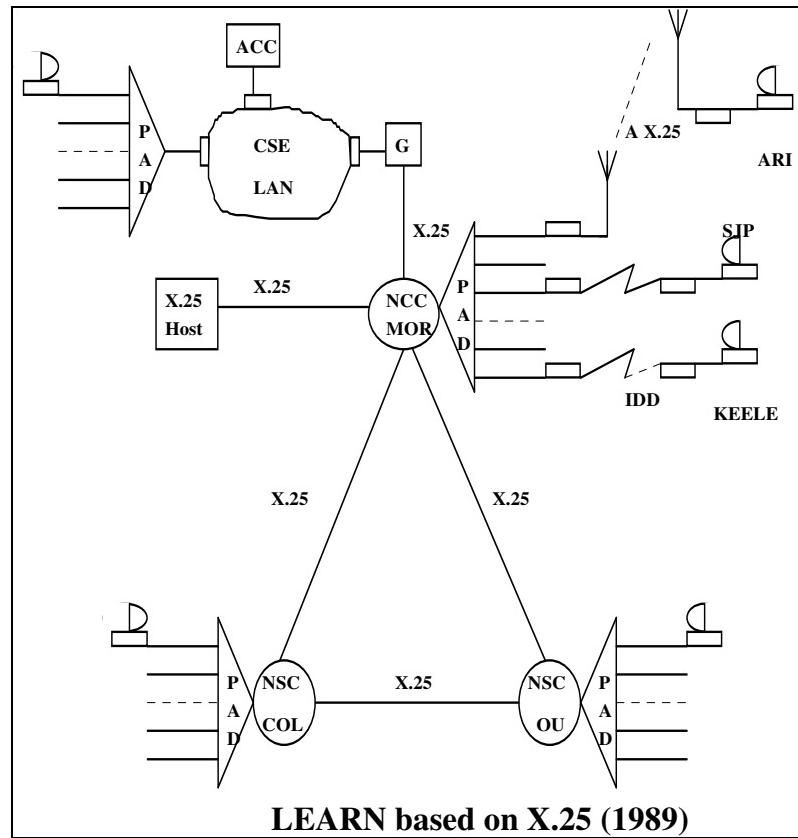


Figure 2 – Proposed LEARN Configuration